STYLO-HYOID OSSIFICATION.

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"*Observavi tamen aliquando processum styloideum usque ad cornua ossis hyoidei pervenire, ipsisque valido nexû devinci.*" *de Marchettis.* Anatomia. Patavii, 1652, cap. xiii, p. 205. Probably the earliest reference to this condition.

Although the occasional recurrence of ossification of the second branchial bar, represented by the styloid process, the stylo-hyoid ligament and the lesser horn of the hyoid, has been repeatedly observed in man, yet the number of well described cases is very small. Le Double in his work on the variations of the facial bones finds only some twenty instances of which one or two have never been published and of which others are very inaccessible. This condition has most frequently been recognized in the living by laryngologists, but it may be said that its clinical importance has not been generally appreciated. It appears, moreover, that there is even among anatomists more or less misunderstanding as to what has actually occurred in these cases, and that the nomenclature of the parts involved is very confusing.

This subject has been particularly brought to my attention by the observation of a very perfect case of ossification of practically the whole chain on both sides in a dissecting room subject. Moreover, the peculiarity was discovered before the dissection was very far advanced so that it was possible to have the body X-rayed before the relations which existed in life had been very seriously changed. At almost the same time two extremely long styloid processes, reaching nearly to the hyoid, were observed on another subject which was also X-rayed. So far as I am aware these skiagraphs are the first that have been made of this condition.

In this paper I propose (I) to describe the composition of the stylo-hyoid chain and to show what occurs in ossification of the chain or of parts of it; (II) to describe cases of extensive ossification of my own observation, and others in the Warren Museum of the Harvard Medical School, and then to mention the peculiarities of a number of other specimens found in literature; and (III) to refer to the clinical importance of this condition.

I.

The Stylo-hyoid Chain.—The second branchial bar or the cartilage of Reichert, extends in early embryonic life downwards and forwards from the skull to meet its fellow to which it is connected by a cross piece the *basi-hyal* which becomes the body of the hyoid. The chain of pieces with which we have to deal does not include the basi-hyal. It consists of four elements. (1) The *tympano-hyal* extending from beside the periotic capsule, which later is enclosed in the petrous portion of the temporal bone, to the lower surface of that bone or a little beyond it. The late Professor Flower was, we believe, the first to suggest the name we have used for this element. French writers call it *le prolongement hyoïdien.* (2) The *stylo-hyal,* which usually forms the greater part of the styloid process: (3) The *cerato-hyal* which is usually represented in the adult by the stylo-hyoid ligament, or by an ossification in the same, and (4) The *hypo-hyal* which becomes the lesser horn of the hyoid. There is unfortunately more or less confusion in the nomenclature. Some writers call the cerato-hyal the lesser horn and some use the term *epi-hyal,* which we have avoided altogether, for diverse elements. Some parts of this cartilaginous chain become bone by the normal process of ossification, but other parts degenerate into fibrous tissue. Before considering the remarkable cases of extraordinary ossification, something should be said of the usual course of events and of minor modifications.

Let us examine very briefly these different parts of the stylo-hyoid chain in a little more detail. First: what constitutes the normal styloid process? There is a very confusing discrepancy of opinions. The soundest view is that according to which it consists of the tympano-hyal and the stylo-hyal. Normally the tympano-hyal projects but very slightly beyond the temporal and shows a rough circular end which is connected with the next piece by cartilage or perhaps by fibrous tissue during adolescence and sometimes for a much longer period. Ultimately it fuses with the styloid which is thus joined to the skull. Yet I have seen a skull said in the catalogue to be of a child of eight, but which I should call some four years older, with the tympano-hyal projecting a centimetre or more from the base and joined to a second piece by a jagged line of union. In several of the anomalies to be described later the tympano-hyal projects considerably.

Sappey, following in the main Geoffroy-Saint-Hilaire, who was the first of modern authors to write on the hyoid chain, makes the styloid process consist of the first and second pieces, but he adds that the cerato-hyal ossifies before the stylo-hyal. In his diagram of what is normal he figures a free ossification in the cerato-hyal. He believes that this fuses with the tympano-hyal and the other where it fuses with the cerato-hyal. The theory that the fusion of the cerato-hyal with the stylo-hyal forms the tip of the styloid is very hard to determine; but it is a plausible explanation of instances when the point of the styloid, especially of a long styloid, joins the shaft at an angle.

Sappey seems to be alone in supposing that the cerato-hyal ossifies before the stylo-hyal. For our part we believe that it is quite exceptional for the cerato-hyal to ossify at all, although sometimes it presents a long slender ossification. It is possible enough that the upper end of this may join the styloid but we do not believe that this is the usual process. The lower end of this ossification may join the hypo-hyal thus making a very long lesser horn. Finally the normal ligament may be absent altogether, the original cartilage having disappeared and left no trace.

The hypo-hyal or lesser horn normally persists as an elongated cartilaginous nodule which is connected to the hyoid by a ligament or by a true joint, and which late in life may be joined to it by bone. Sometimes, indeed, this bony union occurs very soon. The usually small nodule may be long and even double. It may fuse with the cerato-hyal. On the other hand it may be represented by fibres forming the lower part of the stylo-hyoid ligament, in which case the lesser horn is said to be wanting; and finally as in the cases just referred to, there may be not even a ligament. Thus it appears that the process of development presents a great number of individual variations and moreover that the same, or at least a similar, result may be reached by different processes. Thus the styloid need not always be composed of the same pieces, and the lesser horns may be elongated either by uncommonly large hypo-hyals or by their fusion with an ossification in the cerato-hyal.

A most important point in the consideration of cases of almost total ossification of the chain is that this is not to be considered a degenerative change, depending on age. That this idea was formerly held can be shown by quotations from eminent anatomists. Thus Gruber wrote: " Should the stylohyoid ligament become ossified throughout its length and also in rare cases among old people become joined with the styloid process, then the last will reach from the skull to the hyoid as was first observed by de Marchettis and after him by others and myself." Sappey alludes to the ossified cerato-hyals joining the styloids at from fifty to sixty and adds that the styloid process then takes on what he calls a " monumental " appearance twisted and knobbed, which characterizes it in some individuals. Though we believe the joining at that age to be entirely imaginary we quote the passage as showing the existence of the idea that these things come with advancing years.

Debierre, I believe, was the first to protest against this view. He writes, " Mais il ne faut point dire, avec nombre d'anatomistes, que dans certains cas le ligament stylo-hyoidïen s'ossifie. Ce n' est pas ainsi que se rétablit la chaine hyodïene osseuse." Peter who studied a large series of hyoids says of the instances of remarkably long lesser horns that five of the most striking cases occurred in persons of from fourteen to twenty-five years. Le Double insists that it is to be considered a theromorphic manifestation.

The facts are these. It is perfectly true that in certain cases cartilaginous and fibrous tissues degenerate by the deposit of earthy salts into what may be called bone. Although most likely to occur in old age, yet it not rarely occurs early and is apparently to be attributed to constitutional causes.

In point of fact these cases are due chiefly (if not in all details) to the persistence of the embryological cartilage, to its growth to an abnormal size and to its final conversion into bone. This last is not a degeneration of tissue but the normal process as it occurs among animals in general. This is made very striking in most of these cases by the large size of parts of the hyoid chain which could not be explained by the degeneration of ligament. It is very probable also that in some cases in which the bony rod is slender the cartilage has persisted and become bone, because this is more likely than that fibrous tissue should have ossified at that age; but in the former cases the bar of bone is so large that one can only account for it by supposing that the original cartilage continued to grow and then underwent ossification. In these cases the rod is not one continuous piece but is made of several segments which generally present enlargements at their points of junction. The joints between these pieces have not received very satisfactory description. The fact is that they apparently are not true joints at all, but that the still cartilaginous ends of the pieces play one on another within the enveloping fibrous tissue which is continuous with the periosteum. The apposed ends of the bones have the appearance of having been connected by cartilage, and ultimately they become anchylosed to a greater or less extent, which indeed is an ultimate degeneration. Other instances of senile degeneration which has attacked the already abnormal structure will be alluded to in the account of the cases.

II.

Description of Cases.—I shall now describe three recent specimens of my own observation, then two more also in the Warren Museum of the Harvard Medical School which have never been described at length, after which I shall give a short account of several cases recorded in literature, and then give a short summary of the results of the study.

SPECIMENS IN THE WARREN MUSEUM.

CASE 1 (Figs. 1 and 2).—White, male, old. The chain of bones consists on each side of three pieces besides the lesser horn, which on the right is very small and ill defined, lying in the mass of fibrous tissue which passes from the piece above it to the hyoid. On the left it is represented by two nodules, one above the other. The first piece on both sides measures 2 cm. and is enlarged at the lower end, which is movably attached to the second piece, which measures 4 cm. on both sides. Its lower end is also slightly enlarged. It is movably attached on the right; but on the left is fused with the third piece, which is directed strongly forward on either side so as to be approximately parallel with the great horns of the hyoid. This third piece measures 2.9 cm. on the right and only 1.5 cm. on the left. On the right it is continued to the hyoid by a ligament only some 3 mm. long, which encloses the rudimentary lesser horn. On the left the two nodules are enclosed in a ligament of some 7 mm. The largest diameter is about 6 mm. near the lower end of the first piece on the left. Although certain joints were noted, they disappeared when the specimen was dried. It may be considered practically certain that there was no motion of any importance between the different pieces, excepting in the neighborhood of the hyoid. This peculiarity was happily discovered during the dissection before very much had been removed, so that the subject still had the outlines of a human body rather than those of an anatomical preparation. The X-ray reproduced in fig. 2 was taken as soon as possible. It is, so far as I know, the first of its kind.

CASE 2 (Figs. 3, 4 and 5).—The next case was observed at about the same time. H. 402. Male, black, age unknown but young, apparently about twenty-five. This may be called an instance of very long styloid processes. It was noted during the dissection that they seemed to reach to within one or two centimetres of the hyoid. No stylo-hyoid ligament and no lesser horns could be found. The length is 5.9 cm. on the right and 5.3 cm. on the left; but measurements must often be only approximate from the difficulty of getting a really satisfactory and precise starting point. The condition is quite different on the two sides. On the right the tympano-hyal projects but very little beyond the vaginal process. It is connected by fibrous tissue to a long, slender rod, presenting something of an enlargement at its middle, which marks a change of direction. At first it runs forward and downward and then inclines inward as well. There is another bend just before the point. On the left the process is much straighter. The tympano-hyal, which is much stronger than on the right, projects far beyond the vaginal process. It is connected by fibrous tissue with the stylo-hyal, which runs downward and forward without change of direction except for a slight bend backward at the end. The tympano-hyal has a very much greater development on the left than on the right, illustrating beautifully the principle that in such variations the same element may be of very varying importance. It is not unlikely that the point on both sides is made by the cerato-hyal, but there is no way of knowing and it is of no consequence. An X-ray was taken of this head also before the dissection was very far advanced. These two cases were seen near the close of 1906.

CASE 3 (Fig. 6)...No. 9993. Male, black, age 28. This specimen was found in the dissecting room a few years ago, during my administration, and was placed by me in the Museum. There is nothing very remarkable about the styloid processes. The feature is the strong ossification of the lower part of the chain; and again the condition is not the same on opposite sides. The arrangement on the right is as follows: the tympano-hyal is not to be distinguished, the stylo-hyal is ligamentous, 2.6 cm. in length, the cerato-hyal is bone. The length is 4 cm. and the greatest breadth, which is at the top, 5 mm. A ligament 4 mm. long connects the lower end of this ossification with the hyoid. There is no lesser horn.

On the left the tympano-hyal projects just beyond the vaginal process. Next to this comes a ligament 5 mm. long, then an ossification, the stylo-hyal 1.3 cm., which is connected by a ligament 3.1 cm. long to the cerato-hyal, which measures 2.8 cm. and is not only much shorter but much lighter than its fellow. The most important difference is at the lower end of the chain. On the left a lesser horn of 4 mm. springs from the hyoid and is connected by a very little fibrous tissue with the lower end of the cerato-hyal.

The two next cases have been for years in the Warren Museum.

CASE 4 (Fig. 7).—No. 6631. Sex, age and race are not given, but I have very little hesitation in pronouncing it male and I incline to think it is the head of a negro. The right stylo-hyal is a thick rod which about 1.6 cm. from its origin expands into a rounded knob. The shaft is thickest in a line running backwards and outwards, measuring 8.5 mm. The transverse diameter is 4.5 mm. Continuous with the thick rod, which has been assumed to be an elongated stylo-hyal, is a long, slender bony process, extending in a somewhat tortuous course downwards and forwards. This apparently was sawn across before it was observed in the dissection. Apart from this obviously artificial division, the bony rod extends 7.7 cm. from the skull (measured in a straight line), ending in a small knob. There is, of course, no means of knowing how this rod was connected with the hyoid. The attachment shown in the photograph is entirely artificial. There is no lesser horn on either side.

On the left the tympano-hyal projects beyond the vaginal process. It is of about the usual size and has a rough ending as if it had once been covered with non-articular cartilage. This specimen is remarkable for the very large size of the upper part of the rod as well as for its length.

Case 5 (Fig. 8).—No. 602 was placed in the Museum by Dr. David W. Cheever in 1865 during his service as Demonstrator. There is no statement of age, sex nor color. The chief interest is that the chain differs from all the others. It probably did not come from an aged individual, as the greater horns of the hyoid apparently are not fused with the body. Owing in part to the method of mounting it is very hard to determine whether there is any element that can be called a tympano-hyal. The stylo-hyal is longer on the right and thicker on the left. The cerato-hyal is of about the same length on both sides, but is separated from the preceding piece by a longer ligament on the right than on the left. This condition is reversed below this ossification, the ligament going to the lesser horn being longer on the left. These horns measure each 3 mm. and are fused with the greater horns. Thus there is a general correspondence between the two sides with a difference in details.

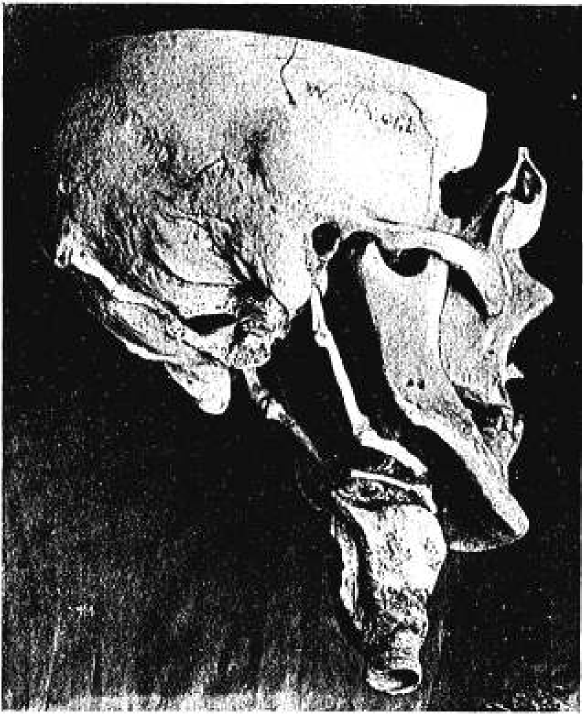
Passing now to cases recorded in literature and without making any attempt at a complete account of all cases observed I give several which strike me as the most interesting and which illustrate the variety of details presented by this abnormal ossification.

Case 6.—Geoffroy-Saint-Hilaire describes a specimen given him by Serres. The body of the hyoid bone was very large, somewhat resembling that of American monkeys. The greater horns were slender and very wide spread. The first piece of the chain, which he calls the styloid, was long and thick, while the cerato-hyal and the apo-hyal (hypo-hyal) were slender, long and straight and swollen at their ends. The last mentioned was longer by a quarter than the one above it. These two appeared to have been but recently united together, and the same is true of the first piece and the vaginal process, although the man was fifty-six years old. Ligamentous fibres connected the lesser horns with the body of the hyoid. This condition was found only on the right.

The following three cases reported by the late Professor Saturnin Thomas, of Tours, are taken from the paper by Retterer.

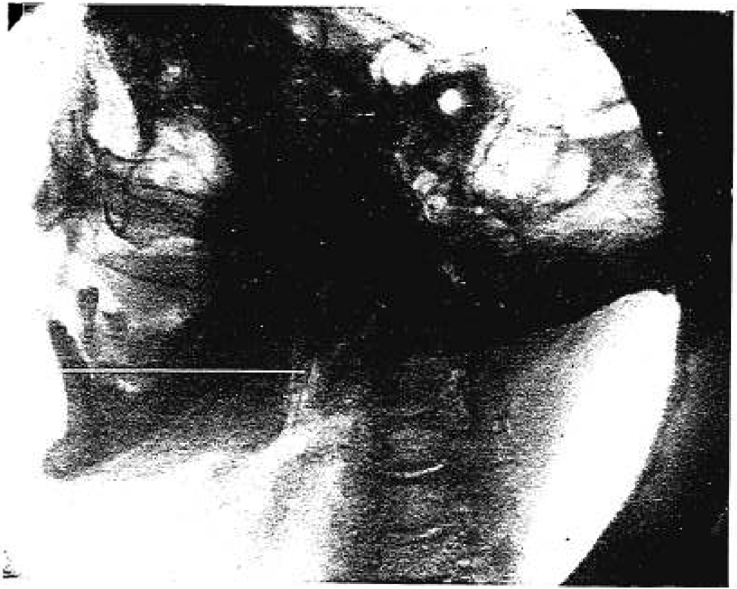
Case 7.—Male, aged thirty. There was a swelling below the vaginal process at the junction of the tympano-hyal (*prolongement hyoidien*)

FIG. 1.



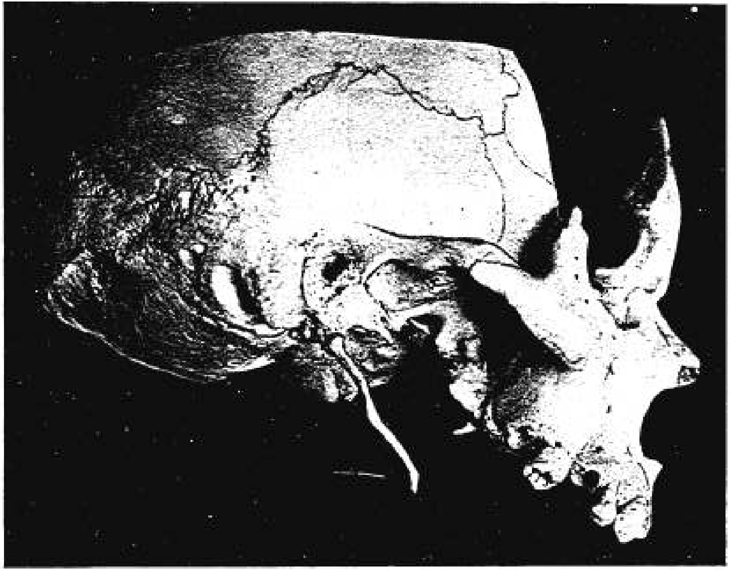
CASE I.

FIG. 2.



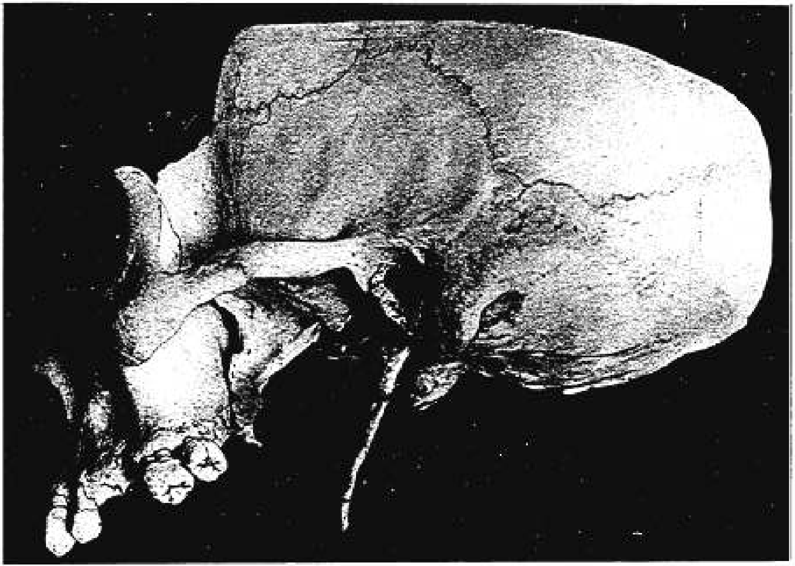
An X-ray of Case I when only partially dissected. The stylo-hyoid chain of one side is shown clearly.

FIG. 3.



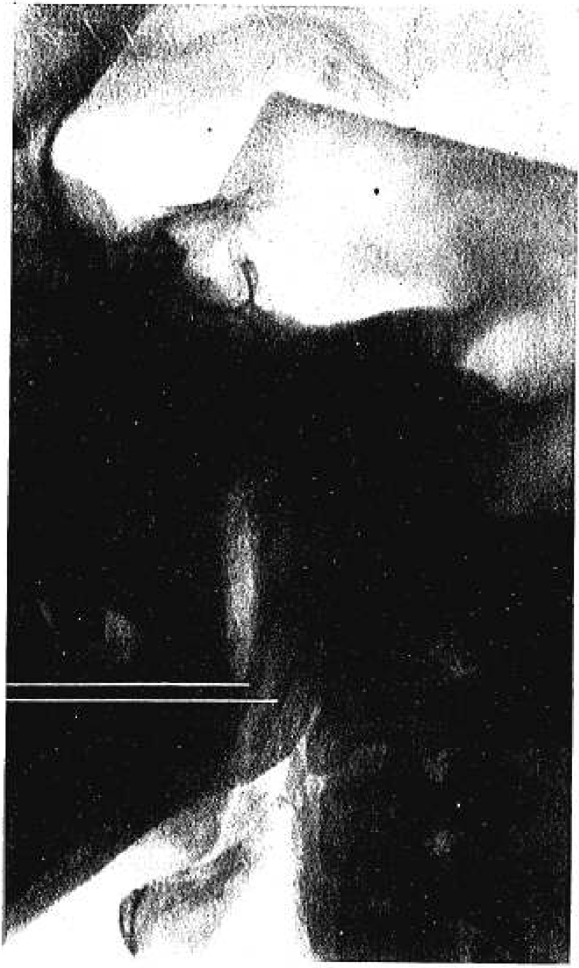
CASE II.—Right side. The tympano-hyal does not project beyond the vaginal process. The styloid process, which is not joined to it by bone, probably consists of the stylo-hyal and cerato-hyal.

FIG. 4.



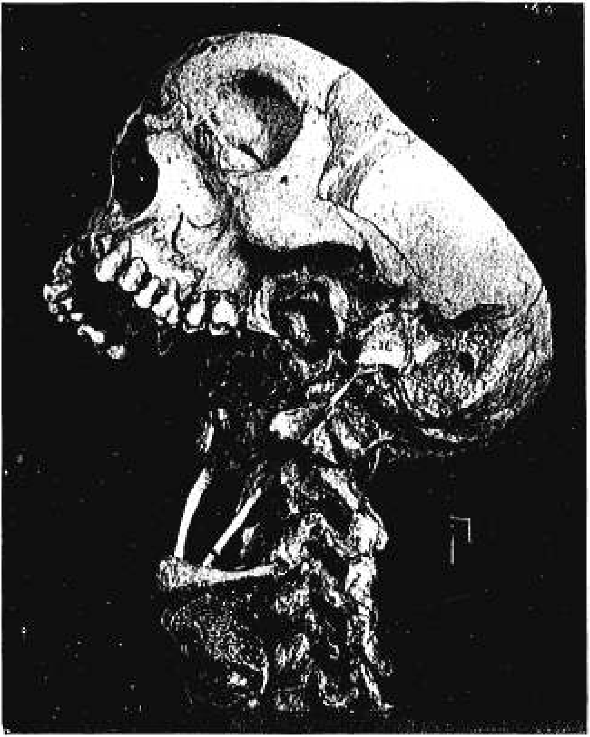
CASE II.—Left side. The strong tympano-hyal is very prominent. There is no bony union between it and the stylo-hyal.

FIG. 5.



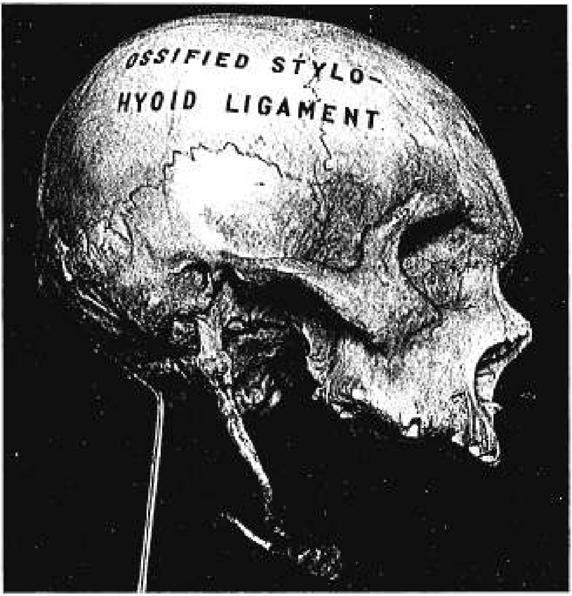
An X-ray of Case II when only partially dissected and before the skull had been divided. Both stylo-hyoid chains are shown.

FIG. 6.



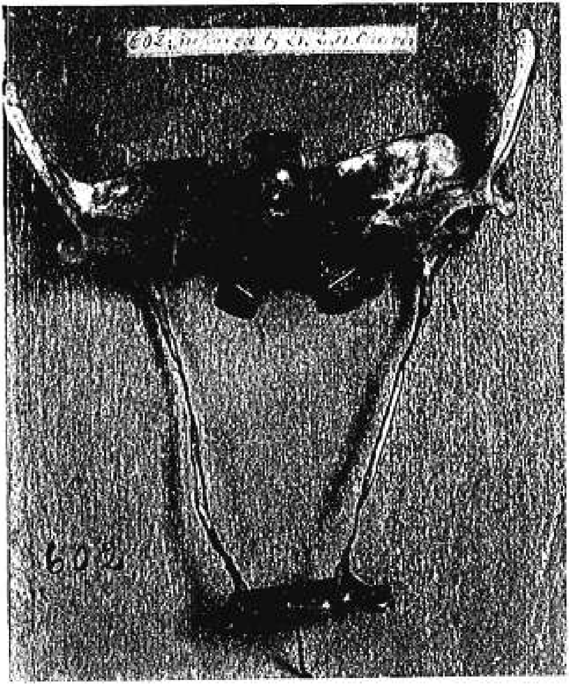
CASE III.—The lower part of the cerato-hyal is a strong bony rod on both sides.

FIG. 7.



CASE IV.—The large first piece is probably an immense tympano-hyal, with which the fused stylo-hyal and cerato-hyal are united.

FIG. 8



CASE V.—The ossification is irregular and asymmetrical.

with the styloid. The lower end of the latter articulated with the cerato-hyal, which was continued by ligament to the hypo-hyal or lesser horn.

CASE 8.—The vaginal process was continuous with the tympano-hyal, of which the lower end was fused with the first piece of the stylo-hyal, which had a fusion at its junction with the cerato-hyal.

CASE 9.—Female, aged fifty. The lesser horn was elongated as in animals. The cerato-hyal was very small and not joined to the piece above it.

No mention is made in the abstract by Retterer as to whether these conditions existed on one or both sides.

CASE 10.—SAPPEY in the third and fourth editions of his Anatomy gives a fine illustration but no description of a case of this kind. Perhaps it is the often mentioned one in the Musée Orfila. Describing it from the drawing, it appears to be essentially symmetrical on both sides. The tympano-hyal projects some distance beyond the vaginal process and ends in an enlargement which meets a similar enlargement of the stylo-hyal. This is the largest point of the bony chain. Below this comes the cerato-hyal, which is connected to the lesser horn by ligament. The drawing represents it as completely fused with the stylo-hyal on the left. In spite of the author's use of the word *"soudure,"* the other above mentioned joints would appear from the drawing to persist.

CASE 11.—GRUBER reports an instance of ossification on both sides in an old person, which apparently was observed on a macerated skull. The hyoid apparently had been lost, but the bony rods were so long and came so near together below that one cannot doubt they very nearly reached that bone. The drawing represents them ending in sharp points, which we are told were 11 or 12 lines (say an inch) apart. The two rods were equally long and showed occasional swellings. The left one was rather stronger than the right. Both had a bend near the middle, that in the right one being the greater. The part above the bend was slightly curved on both sides and the lower portion straight.

CASE 12.—POIRIER and MEUNIER had a remarkable case of very perfect ossification of this ligament from a person, sex not stated, of thirty years. The greater horns of the hyoid were remarkable for their size and for the presence of a small nodule at their ends, connected with them by some kind of a joint. The stylo-hyoid ossifications of the two sides were practically symmetrical. They presented the following pieces: the styloid process, a long piece divided into two, showing a swelling and remnant of a suture at the junction of the first and second third; then the little horn of the hyoid, surrounded by fibrous tissue, connecting it both with the last mentioned bone above, and with the hyoid below.

CASE 13.—The following case from a man of sixty-four, reported by MEUNIER is in one respect unique;[1] namely, that the hyoid bone and the (ossified) thyroid cartilage were united. The ends of the greater horns of the hyoid were connected with the superior horns of the thyroid by joints which apparently once had been true joints. On the right, indeed, the joint was quite lost, being represented merely by a swelling. On the left the joint still existed, but in such a condition that there was no motion on either side. The hyoid in this case was peculiar. The body was large and deeply hollowed. Moreover it was surmounted in the middle by a tubercle projecting towards the muscles of the tongue suggestive of the *uro-hyal* of mammals. The stylo-hyoid chains were not symmetrical. The right one was slender and nearly straight. It consisted of the stylo-hyal, the epi-hyal, which was a small nodule in the ligament from the stylo-hyal, to another long piece which represented the cerato-hyal and the hypo-hyal. A swelling at the lower third marked the point of their union. The left chain was larger and more tortuous. First there was the stylo-hyal joined by a fibrous sheath to a long second piece, 5 mm. thick, which represents both the epi-hyal and the cerato-hyal. The point of union is marked by a swelling at the upper third. This compound second piece ended below in a swelling which rested on the outer end of the body of the hyoid, but leaving room between it and the greater horn for the presence of a detached nodule as large as a pea, which is the hypo-hyal. I infer that the chains were continuous with the temporal bones, but this point is not stated as clearly as could be wished. On the right there was some play between the first and second pieces, and on the left there was more motion at the different joints. It is tolerably certain, as the author implies, that the joints were degenerating and that earlier in life they permitted more motion. The thyroid was abnormally close to the hyoid.

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[1] This is unique among variations of this class, but Debierre describes a hyoid which had true joints on the under side of the ends of the greater horns to articulate with the tips of the thyroid horns.

CASE 14.—RETTERER'S case is a very striking one. It was observed on both sides of a man of sixty. The body of the hyoid was very large, with widely diverging greater horns. The two sides differed considerably. On the right the bony rod measured 9.5 cm., with an average diameter of 5 mm. It consisted of two pieces, the upper measuring 2.5 cm. and the lower 7 cm. There was an enlargement at their junction which was surrounded by fibrous tissue and at which some indefinite motion was allowed. The upper piece rested against the vaginal process and was not fused with the temporal; the lower was attached to the hyoid by fibrous tissue. On the left the styloid, 1 cm. long, was fused with the temporal. (Very probably this was the tympano-hyal.) Its lower end was attached movably to the stylo-hyal, 1.5 cm. long, from which a cord ran to the cerato-hyal, 3.5 cm. long. The lower end of this was continued by a ligament of 1.5 cm. to the lesser horn, which measured 2 cm. and was movable on the hyoid. These two chains passed about 2 cm. internally to the ramus of the jaw and were connected with the fibrous tissue covering the internal pterygoid.

The following case by Turner much resembles case 4.

CASE 15.—"On the right side of a male subject, the styloid process, 31 mm. long, was from two to three times as thick as customary; and instead of ending in a point, formed an expansion, 13 mm. in antero-posterior, and 9 mm. in transverse diameter. Below, and articulated with it by a movable joint, was a bar of bone, 56 mm. long, which passed downwards to articulate with the small cornu of the hyoid. This bar was thickest at its upper end, and measured 10 mm. antero-posteriorly, and 8 mm. transversely, whilst at the lower end its dimensions were only 4 by 3 mm. The small cornu was somewhat thickened, and had its usual articulation at the junction of the body with the great cornu of the hyoid, which parts of that bone had their customary appearance. When the right arrangement in this neck is compared with the normal condition in a dog, the bar of bone is seen to be the homologue of the epi-hyal bone in this and many other mammals. There was no vestige of a right stylo-hyoid ligament, the place of which had been taken by the epi-hyal."

The left side was practically normal.

CASE 16.—MR. E. T. PORTER exhibited before the Dublin Pathological Society a specimen of abnormal styloid processes which, as he observed, was of more interest from an anatomical than a pathological point of view. They were styloid processes, much longer than usual, and not so firm and osseous, but rather slender and flexible. They were attached to the temporal bone by cartilage, instead of bone, and in the same subject there was no styloid muscle or ligament. They were situated between the carotids, and so placed that it would have rendered ligature of either vessel extremely difficult.[1]

CASE 17.—The following very remarkable case described by KOSTANECKI is unique. It was observed on the left side of a man of sixty-four. A projecting plate of bone turned backward from where the angle of the lower jaw should have been and played against a really immense styloid, by what may be called a false joint or a bursa, but the description is inadequate. The styloid, or more accurately, the stylo-hyoid chain, consisted of two long pieces with a small, flat, rounded piece of bone of irregular shape between them, which was connected by a false joint with each of the others. The first piece was a thick, rounded rod descending from the skull and becoming broader below. The lowest piece, short and thick, was connected by a ligament (which must have been a short one) with the lesser horn. The intermediate piece was surrounded by a dense envelope of fibrous tissue seemingly continuous with the periosteum of the others. The process on the lower jaw was against the joint below the intermediate piece when the mouth was closed. It was learned that the man had had no symptoms during life.

Besides the above, which may be called dissecting-room cases or museum specimens, there are a few clinical observations on the living. As long ago as 1870 Lücke reported two cases.

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[1] It may be questioned whether this case should have been admitted; for, of course, if we are to record uncommonly long styloids there will be no end to it. But it must be remembered that styloids which deserve to be called "much longer than usual" probably reach very nearly to the hyoid, like those of my second case, as was noted in the dissection and confirmed by the X-ray.

CASE 18.—The first was that of a woman of thirty who had long suffered from difficulty in swallowing. An examination of the fauces made both within and without, revealed on the right a long slender process which pressed the tonsil inward.

CASE 19.—His other case was that of a girl of twenty, who also had difficulty in swallowing. Again there was found on the right side a slender, bony process which pressed against the tonsil. It is stated moreover that in this second case it narrowed the posterior nares on the right.

The first and most important deduction to be made from these cases is that the usual term "ossification of the stylo-hyoid ligament" is wrong and misleading. On the contrary, they support the contention that this condition is due to a continued growth and subsequent ossification of the second branchial cartilage. This does not prevent a degenerative ossification from playing a minor part which probably manifests itself most strongly in the destruction of the joints between the different pieces occurring late in life.

The condition is a theromorphic one; that is, one in which parts of the human body show an exceptional structure which is normal in certain animals as a consequence of a common plan of development.

In at least three instances the hyoid was enlarged. In that of Serres "the body of the hyoid was very large . . . the greater horns slender and very wide-spread." In that of Poirier and Meunier "the greater horns of the hyoid were remarkable for their size . . ." In Retterer's "the body of the hyoid was very large with widely diverging greater horns." It is likely that this would have been recorded much more frequently had all the hyoids been examined.

The sex is given in 12 cases. Of these 9 occurred in men (to which might be added one in which I made the diagnosis from the skull) and only 3 in women.

As to the age: 6 were fifty years or more and 6 less than fifty. Assuming that I was right in estimating the age of my second case at about twenty-five, none of these 6 had reached thirty-one years. It is clear that old age is not a factor.

The condition is usually bilateral. It is so in 10 of these cases, in 5 it is on the right and in 1 on the left. There is no statement concerning 3 instances.

While it may be said that those in which the ossification was found on both sides were in the main symmetrical; yet it is common to find considerable departures from symmetry in the details, such as the value of certain elements of the chain and arrangement and efficiency of certain joints.

The condition of the joints between the different pieces, including the lesser horns of the hyoid, is very uncertain. In many cases it would appear that joints once present had degenerated; but there is no single case in which the hyoid is firmly attached to the chain so that no motion is possible between them. The nearest approach to this is in Meunier's case (13) in which there is a bony connection in an old man between the thyroid and the hyoid, a change, which as mentioned above, probably occurred late in life. In short, there is usually more or less play between different parts of the chain and practically always near the hyoid, sometimes by a joint below the lesser horns and sometimes by a joint or more often a ligamentous connection above.

III.

The clinical deductions I venture to assume to be the following:

It is to be remembered that a bony rod may extend from the styloid process to the hyoid. It may be slender or thick. In the former case it is at least in early life, more or less flexible and elastic; in the latter it presents enlargements which at first, as a rule, mark the position of joints. This rod passes between the carotid arteries and may interfere with operations for tying them, and with those on the parotid gland which it probably indents on the inner side. Passing by the internal pterygoid, to which it is attached by the fibrous envelope of that muscle, it lies against the outer side of the tonsil which it may indent or displace. It evidently would interfere with excision of the tonsil by the tonsilotome or otherwise. Some years ago I received a letter from a laryngologist who had come across such a structure while operating. I believe that others have had the same experience but I know of no instance which has been reported. The displacement of the tonsil may be sufficient to seriously reduce the approach to the pharynx and even to encroach on the region back of the posterior nares.

It may give rise to difficulty in swallowing. In this connection it is worth noting that the two cases observed during life by Lücke were both young. One would think that the trouble would be greater after the solidification of the joints, especially if the joints above and below the lesser horns of the hyoid should be involved, but as yet there is no clinical evidence.

It is not unlikely that the play of one part of the rod on another should give rise to disagreeable subjective symptoms and even to sounds that could be heard by others, although Kostanecki's remarkable case (17) shows that this does not necessarily occur.[3]

A diagnosis may be made by bimanual examination and the X-ray would settle the matter.

BIBLIOGRAPHY.

(Some papers are included which have not been referred to.)

Debierre, Bull. Soc. Zool. de France, 1885.

Folet, quoted by Nicholas.

Flower, Brit. Assoc. Advance. Science, 1870.

Gruber, Virchow's Archiv., Bd. 50 and Bd. 70.

Kostanecki, Virchow's' Archiv., Bd. 123.

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[3] The late Professor Henry J. Bigelow told me many years ago that perhaps the most curious case he had ever seen was that of the "clicking woman," who, I believe, went for advice to the Massachusetts General Hospital, and left not only unrelieved, but without the satisfaction of a diagnosis. As well as I can remember she was troubled by a continual, plainly audible clicking, which seemed to be produced in the region of the larynx.

Le Double, Traité des Variations des Os du Crane.
Leidy, Elementary Treatise of Human Anatomy.
Lücke, Virchows' Archiv., Bd. 51.
Meunier, Bull. Soc. Anatomique de Paris, 1888.
Monro, Elements of Anatomy, 1835.
Nicholas, Revue Biol. de la Nord de France, 1894.
Peter, Dissert. Inaug. Bâle, 1888.
Poirier, Anatomie Humaine.
Poirier et Meunier, Bull. Soc. Anat. de Paris, 1887.
Porter, Report of Dublin Pathological Soc. in Dublin Quar. Jour. of the Medical Sciences, vol. 56.
Retterer, Compt. Rendus. Soc. Biol. de Paris, 1886.
Romiti, Tratt. d'Anat.
Saint-Hilaire, Philosophie Anat., 1818.
Sappey, Anat. Humaine, third and fourth editions.
Serres, see St. Hilaire.
Spee, v. Bardeleben's Handbuch der Anat. des Menschen.
Thomas, Elements d'Osteol., quoted by Retterer.
Turner, Journ. of Anat. & Phys., vol. 36.